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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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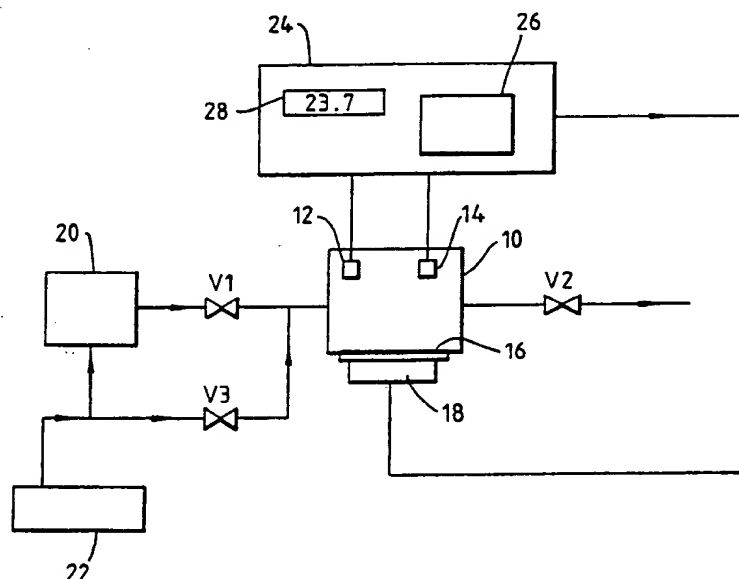
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(54) Title: APPARATUS FOR, AND METHOD OF, PROVIDING AN ATMOSPHERE OF PREDETERMINED HUMIDI-  
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## (57) Abstract

An apparatus for providing an atmosphere of predetermined humidity comprises a chamber (10), a source (22) of dry air, leading to the chamber (10) directly via a valve (V3) and a saturator (20) having an inlet connected with the source (22) and an outlet connected with the chamber (10) via a valve (V1). An outlet from chamber (10) is connected via a valve (V2) with an extractor, whereby with valves V2 and V1 open and valve V3 closed, saturated air can be drawn into chamber (10) whilst with valves V2 and V3 open and valve V1 closed dry air can be drawn into chamber (10), to adjust the humidity in the chamber (10) in either case. A relative humidity sensing probe (12) and a temperature sensing probe (14) within chamber (10) pass signals to a computer (24) which controls valves V1, V2, and V3, whereby feed-back regulation of the humidity in chamber (10) can be achieved.

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Title: "Apparatus for, and method of, providing an atmosphere of predetermined humidity"

THIS INVENTION relates to an apparatus for and a method of providing an atmosphere of predetermined humidity,, for example for use in calibrating humidity measuring instruments or for storing items which require to be kept at a particular humidity.

A number of methods are available for providing atmospheres of known humidities. One traditional method is to mix wet air with differing quantities of dry air to produce different humidities. Another method is to maintain the volume of air concerned over a solution of saturated salts and in moisture equilibrium with the latter. These known methods are expensive and/or time consuming.

It is among the objects of the present invention to provide an improved apparatus for and method of, providing an atmosphere of predetermined humidity.

According to one aspect of the invention there is provided apparatus for providing an atmosphere of predetermined humidity, comprising a chamber for containing such atmosphere, means for supplying dry air and moist air to said chamber and means for drawing air from said chamber, control means for controlling the relative amounts of dry air and moist air supplied to the chamber to afford a coarse adjustment of humidity, and fine control means including moisture removal means for removing moisture from the atmosphere in said chamber, the apparatus including a control facility controlling said dry and moist air

supplying means, and said means for drawing air from the chamber, and/or controlling said moisture removal means, said humidity sensing means providing its output signal to said control facility.

An embodiment of the invention is described below, by way of example, with reference to the accompanying schematic block diagram.

Referring to the block diagram, the apparatus includes a small chamber 10 within which are placed a reference dewpoint or relative humidity measuring probe 12 and a temperature sensing probe 14.

Exposed within the chamber, for example forming one wall of the chamber, or part of one wall, is a surface, indicated at 16, of which the temperature can be closely controlled, and which, more particularly, can be cooled with respect to its surroundings, for example thermoelectrically using a Peltier cooling device (indicated schematically at 18) or by passing a cool liquid through passages within a metal body affording the surface 16. If desired, several walls of the chamber 10 may have such surfaces 16 which can be controllably cooled in the manner indicated.

The chamber 10 is connected via a valve V2 with an air extractor or suction pump, via a valve V1 with an air saturator 20 and via a valve V3 with a source 22 of dry air. When valves V1 and V2 are open and the extractor or pump operated, dry air is drawn from the source 22, via an air conduit into the saturator 20 and, in passing through the saturator 20, becomes saturated with moisture. The saturated air then passes, via the valve V1, into the chamber 10.

The valves V1, V2 and V3 are electrically operable valves controlled by a computer 24, for example a microcomputer, having a keyboard 26 and a display 28. The humidity probe 12 and the temperature probe 14 provide electrical signals, significant of the respective values sensed to the computer 24. In practice, for precision, the humidity sensor may operate by measurement of dewpoint, for example in a repeating cycle.

The system functions as follows:

If a known humidity (or dewpoint) is required, this number is simply entered into the computer 24 by the action of the keyboard 26. The computer then determines, on the basis of the signals from the probe 12, whether the atmosphere already present in chamber 10 needs to be humidified or de-humidified. If the atmosphere needs to be humidified, then valves V1 and V2 are opened and saturated air flows into the chamber until such time as there is a slight excess of water vapour in the measuring chamber (i.e. if the required dewpoint was 5°C, saturated water vapour would be allowed to flow until the dewpoint was say, 10°C). V1 and V2 are then closed. Conversely, if the chamber moisture content is too high, then V1 is shut and V2 and V3 are opened to allow dry air to flow through the chamber until the moisture content is merely slightly in excess of the desired amount.

Thus, at this stage there is confined within chamber 10 an amount of air at a dewpoint slightly higher than the required dewpoint. The surface 16 is now cooled until condensation forms on the surface and the surface 16 is kept cool until sufficient condensation is deposited on the surface 16 (and thus removed from the atmosphere within chamber 10) to dry the atmosphere in chamber 10 down to the

desired dewpoint, as sensed by the probe 12. The digital computer 24 thus forms part of a control loop which keeps the temperature of surface 16 adjusted to remove precisely the amount of water from the atmosphere in the chamber 10 to keep the dewpoint at precisely the required dewpoint. The temperature of the chamber is constantly measured by the temperature measuring probe 14 and both these signals of temperature and dewpoint are fed to the computer 24 which can calculate the relative humidity or the moisture content of the atmosphere as required, and, for example, display the calculated value on display 28. Indeed, facilities preferably exist in the software programming of the instrument to allow the desired control point to be entered either as dewpoint or relative humidity or moisture content. The overall temperature of the chamber 10 may be regulated, for example utilising further heating and/or cooling means (not shown) controlled by the computer 24 in a further control loop, to minimise the extent to which moisture must be added to or removed from the atmosphere in the chamber to maintain a predetermined relative humidity.



## CLAIMS

1. Apparatus for providing an atmosphere of predetermined humidity, comprising a chamber for containing such atmosphere, means for supplying dry air and moist air to said chamber and means for drawing air from said chamber, control means for controlling the relative amounts of dry air and moist air supplied to the chamber to afford an adjustment of humidity, means for sensing the actual humidity of the atmosphere in said chamber and for providing a feed-back signal to said control means.

2. Apparatus for providing an atmosphere of predetermined humidity, comprising a chamber for containing such atmosphere, controllable moisture removal means for removing moisture from the atmosphere in said chamber, means for sensing the actual humidity of the atmosphere in said chamber and for providing a corresponding feed-back signal to control means arranged to control said moisture removal means so as to remove moisture from said atmosphere only so long as the humidity in said chamber is above said predetermined humidity.

3. Apparatus for providing an atmosphere of predetermined humidity, comprising a chamber for containing such atmosphere, means for supplying dry air and moist air to said chamber and means for drawing air from said chamber, control means for controlling the relative amounts of dry air and moist air supplied to the chamber to afford a coarse adjustment of humidity, and fine control means including moisture removal means for removing moisture from the atmosphere in said chamber, the apparatus including a control facility controlling said dry and moist air supplying means, and said means for drawing air from the

chamber, and/or controlling said moisture removal means, said humidity sensing means providing its output signal to said control facility.

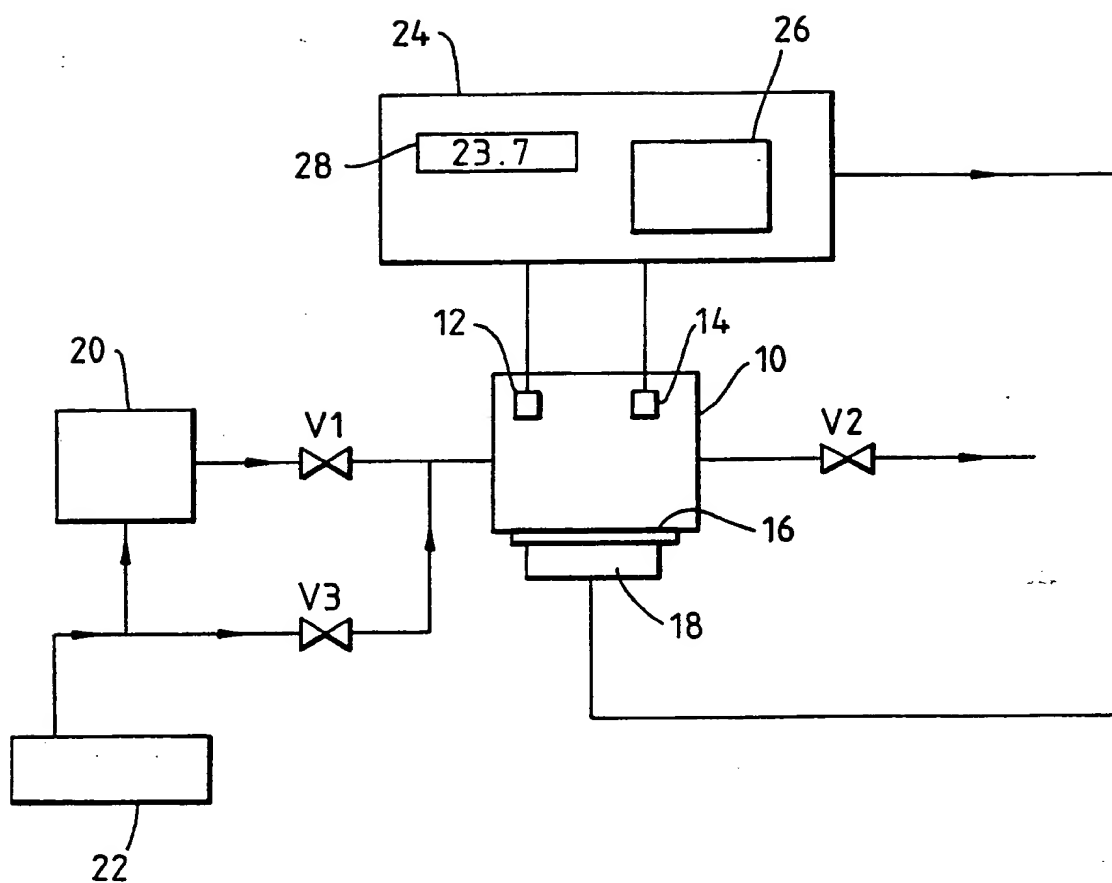
4. Apparatus according to claim 2 or claim 3 wherein said moisture removal means includes a cooled surface upon which condensation of moisture from said atmosphere can take place, to remove such moisture from said atmosphere, and means for controlling the temperature of said surface to control moisture removal by said moisture removal means.

5. Apparatus according to claim 3 wherein said control facility comprises a computer.

6. A method of providing an atmosphere of predetermined humidity comprising mixing dry and moist air into a chamber to afford an atmosphere, in the chamber, which has a humidity which is slightly higher than said predetermined humidity, and removing moisture from the atmosphere in said chamber until said predetermined humidity is reached.

1/1

Fig.1.



## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 92/00910

**I. CLASSIFICATION OF SUBJECT MATTER** (if several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 G05D22/02

**II. FIELDS SEARCHED**Minimum Documentation Searched<sup>7</sup>

Classification System

Classification Symbols

Int.Cl. 5

G05D ;

G01N

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched<sup>8</sup>**III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>**

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	AU,A,501 831 (UNIVERSITY OF SYDNEY) 6 April 1978 see page 2, line 1 - page 14, line 17; figure 1 ----	1-6
Y	AU,A,598 532 (NEIL KIRBY) 22 October 1987 see page 2, line 5 - page 6, line 20 ----	1-6
A	AU,A,574 009 (NIPPON YUSEN KAISHA) 23 June 1988 see page 1A, line 10 - page 6, line 18 ----	1-6
A	US,A,4 356 834 (LEMAY) 2 November 1982 see column 1, line 5 - column 2, line 21; figures 1,2 ----	1-6
A	FR,A,2 606 900 (JACQUIN) 20 May 1988 see abstract; claims 1-5; figure 1 ----	1-6

<sup>10</sup> Special categories of cited documents:<sup>"A"</sup> document defining the general state of the art which is not considered to be of particular relevance<sup>"E"</sup> earlier document but published on or after the international filing date<sup>"L"</sup> document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<sup>"O"</sup> document referring to an oral disclosure, use, exhibition or other means<sup>"P"</sup> document published prior to the international filing date but later than the priority date claimed<sup>"T"</sup> later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<sup>"X"</sup> document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step<sup>"Y"</sup> document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.<sup>"&"</sup> document member of the same patent family**IV. CERTIFICATION**

Date of the Actual Completion of the International Search

10 AUGUST 1992

Date of Mailing of this International Search Report

21. 08. 92

International Searching Authority

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SCHOBERT D.A.V.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. GB 9200910  
SA 59491**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AU-A-501831	28-06-79	None	
AU-A-598532	28-06-90	AU-A- 7143087	22-10-87
AU-A-574009	23-06-88	None	
US-A-4356834	02-11-82	None	
FR-A-2606900	20-05-88	None	

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